THE SUPPLEMENT TO THE

Tropical Agriculturist and Magazine of the C. A. S.

No. 4.] OCTOBER, 1912. [Vol. XI.

RUBBER TREE DISEASES.

LECTURE TO KALUTARA PLANTERS BY MR. PETCH.

INTERESTING INFORMATION AND USEFUL HINTS.

The members of the Kalutara Planters' Association assembled in force at the Tebuwana Club-house on Wednesday afternoon to listen to remarks by Mr T Petch, B.SC., B.A., Mycologist on the staff at Peradeniya Botanic Gardens, about diseases of the rubber tree. The matter is one that vitally affects the interests of the rubber planters, and the large attendance testified to their keen desire to know more of the subject.

Several planters who attended the meeting brought sections of trees affected by diseases which were examined by Mr Petch, and the nature of the disease explained. During the lecture Mr Petch exhibited different sections of trees and showed how diseases could be detected. He also illustrated his observations with diagrams.

The chair was occupied by Mr. H Inglis, Chairman of the Kalutara Planters' Association, and there was a large number of planters present :—

THE CHAIRMAN INTRODUCES MR PETCH.

After the minutes of the last general meeting had been confirmed,

The CHAIRMAN—said:—The only item on the Agenda this afternoon is a lecture by Mr. Petch on "The Diseases of the Rubber Tree.' 'At the last Committee meeting of your Association it was stated by some members that a certain amount of canker and other diseases of the rubber tree were in the district. The health of the rubber tree is of great importance to all of us here—(hear, hear)—so your Committee decided to ask Mr. Petch to come down here and tell us what he could about the matter and enable us to identify any disease when we see it, and tell us how to eradicate the disease. (Hear, hear.) Mr Petch very kindly agreed to our request and he has come down here at a great deal of trouble to himself to help us. (Applause.) Mr Petch as most of you know, is the Mycologist on the staff of the Peradeniya Botanical Gardens, and I think he is known to most of us here personally, but to all of us through his writings. (Hear, hear.) Those interesting circulars that are periodically issued from the Botanic Gardens are many of them written by him and lately he has issued a very valuable book on the "Physiology and Diseases of the Hevea Baziliensis"—a book every rubber planter should have in his library. (Hear, hear.) ["On estate account!" (Laughter.)] I know you are all anxious to hear what Mr Petch has got to say, so I will ask him to kindly give us his lecture. (Applause.)

THE LECTURE.

Mr T. PETCH, who on rising, was greeted with applause, said: I may congratulate the members of the Kalutara Planters' Association on the fact that it is now eight years since the Government Mycologist addressed them. I am not quite so certain how to regard the coincidence that the subject on which information is sought today, that is, Hevea canker, is the same as that on which you were addressed eight years ago. Of course, we have discovered more about the disease since then, but the main difficulty experienced by the planter appears to be still the more elementary point, how to recognise it. The outward indications of "Canker" are, as a rule, not remarkably conspicuous,—a slight darkening of the bark, or in more advanced cases an exudation of a brown, rusty liquid. But if any suspicious-looking patches are lightly scraped so as to remove only the outer corky layers, the indications of canker, if present, are immediately revealed. On normal Hevea bark, the

layer which underlies the cork is usually green, and the laticiferous layer is white, yellowish, or clear red. Consequently, when healthy bark is scraped, the first living layer met with is green, and if this is cut away the inner layers are found to be white, or clear red, or mottled red and white. But when cankered bark is scraped, the layer immediately beneath the cork is black; and if that is cut off the laticiferous cortex is seen to be a dirty red, which changes rapidly to dirty claret-coloured. Usually the discoloured patch is surrounded by a black line, and it is often mottled with black. I have here a painting which shows characteristic Hevea canker in its fully developed form after the outer layers of the cortex have been cut away. There is an earlier stage than this, in which the diseased cortex is a greyish yellow colour and appears sodden. These patches are usually surrounded by a dark line as before. Here is some possibility of making a mistake over the earliest stage. There are certain types of cortex which are greyish-yellow and yet are not diseased. For example, there is a smooth-barked tree which yields very little latex and has a greyish-yellow cortex which is somewhat granular; but as that type of cortex occurs over the whole tree and yet the tree continues to flourish, it cannot be due to canker. There should not be any difficulty in distinguishing that type of cortex from early stages of canker, if it is remembered that the latter occurs in patches, clearly distinct from the general internal colour of the cortex. The

CLARET-COLOURED STAGE OF "CANKER"

is unmistakable, and with a little practice the earlier stage is equally readily recognised. There is no long interval between the two stages: when I say "earlier," I only mean earlier by a few days. The disease begins in the outer layer of the cortex and gradually penetrates to the cambium. At the same time it spreads up and down and round the tree. It travels more rapidly up and down than laterally, and in some cases forms a patch two or three feet in length on one side of the tree only. The wood beneath the canker patch is discoloured, but chiefly by fungi which follow the canker fungus. In diseases like this, the wood appears to be poisoned by the products of decay of the cortex rather than destroyed by the fungus which causes the disease. When the cortex and the outer layers of the wood are killed right round the tree, of course it dies. The diseased cortex is moist and has a peculiar smell. Boring beetles are often attracted by it, and we receive numerous samples of supposed damage caused by borers which turn out to be cases of canker. It is safe to say, on our present knowledge, that all the borers found in the stems of Hevea follow a previous attack of fungus disease of some kind, usually canker or pink disease.

Cases of "canker," such as I have just described, practically never show any cracks or scales on the diseased patch. The surface is quite smooth and unbroken, and the first thing the planter notices is that a brown liquid exudes, or the stem is attacked by borers. If the "canker" occurs between or along the tapping cuts, he may notice that the latex does not flow. No latex exudes from cankered bark, but, of course, that is not necessarily a sign of canker. But a tree should be examined for canker whenever the latex does not flow, especially if it flows from one or two cuts and not from the others. Two years ago, I should have concluded my description of canker at this point. But recently other appearances of the disease have been noted. In the cases just described—what I should regard as the normal case—the disease, if untreated, progresses until the tree is killed; and the tree dies with its cortex unbroken. But I have seen several cases lately in which the tree has begun to heal itself: and in those cases the appearance (that is, after the healing process has set in) is not the same as in normal canker. From experience of Hevea in cacao, I have always opposed the idea that there could be any extensive self healing, but from what I have seen this year I must admit that it can occur, at least in the Low-country in a season like the present. Indeed most of the canker found at this date is in course of healing. The course of events in these cases runs as follows:—The fungus begins its attack on the outer layers of the cortex in the ordinary way. It produces the usual coloured patch, and penetrates, say, to half the thickness of the cortex. Then it stops, and the tree begins to cut out the diseased patch by a layer of cork cells. While the disease is advancing, the symptoms are just the same as those already described,—the diseased patch is claret-coloured and soft. But when the tree begins to cut out the dead tissue, the appearance changes.

THE DEAD PART DRIES UP AND BECOMES BROWN

internally, and it forms a scale which can be easily removed. The inner side of the scale is usually moist and covered with a soft white layer. That layer is not fungus, but newly-formed cork cells. Beneath the scale, the cortex is healthy and yields latex, but its surface is

usually rough. When the scale dries, it frequently cracks, so that the result is a cracked scaly patch, quite different from the canker in its progressive stage. It is often difficult to say whether a scaly patch has been caused by canker or not, once the scales have become dry. If a patch of dead dry bark is found embedded in healthy cortex, that is almost certainly a self-healed case of canker. At the present time, it would be preferable to treat all scaly bark as possible old cases of canker. But the disease should be found at an earlier state than this. Why the fungus does not continue to grow and ultimately kill the tree in these cases can only be surmised; personally, I should consider it a result due to the weather, but it is open to anyone to argue that the fungus has become less virulent or the tree more resistant. I may here remark that if the mycologist is to identify a case of canker from a sample of bark only, he must receive it within 24 hours of the time of taking it from the tree. If the sample is left on the verandah for two or three days, or if the V A motors it round the district and posts it at the end of the week, the diagnosis is a matter of chance. Of course, it would be possible to make a correct determination even in that case, given about a month's work on the specimen for fixing, embedding, section cutting, staining, etc.; but we cannot afford that, and it is quite unnecessary if the sample is posted immediately in a tin.

The Fungus.

The fungus which causes canker is a *Phytophthora*, a member of the same family as the fungus which is the cause of the most serious Potato disease. It cannot be detected without a microscope: it does not produce any large fructification or strands of mycelium as *Fomes semitostus* does. Here are drawings of various stages of the fungus. It permeates the diseased tissue, and ultimately puts out a small tuft of threads which produce lemon-shaped bodies known as sporangia. These sporangia become detached, and are washed away by the rain or blown away to other trees. If the sporangium falls on a wet surface, its contents divide up into a number of small masses of protoplasm. Then the apex ruptures, and these masses are extruded. Each is provided with two threads which are in constant movement, and with the aid of these it swims about in the film of water. These bodies are called zoospores. Ultimately they come to rest, round off and enclose themselves in a cell wall, and finally germinate like ordinary spores. The germ tube, or primary thread, bores into the cortex of the Hevea, and so reproduces the disease. That is the typical life cycle, but there may be variations. The sporangium in some instances does not produce zoospores, but behaves as an ordinary spore. And under certain conditions, the fungus produces "resting spores,"—thick-walled spores which preserve it through the dry weather. Such resting spores are formed within the diseased tissue. They carry the fungus over from one wet season to the next, but the chief means of spread during the wet weather is the sporangium and the zoospores. In addition to causing Hevea canker, the same fungus

ATTACKS HEVEA FRUITS,

and produces the well-known pod disease. It is to be expected therefore that an extensive attack of pod disease will be followed by an increase of "canker." Arguing from analogy with the cacao disease, some part of the dying bark of green branches which occurs in connection with the pod disease is due to the same fungus, but that has not been definitely established. The fungus of Hevea canker is the same as that which causes cacao canker, and the symptoms of the two diseases are practically identical. In cacao, however, where the fruits are borne on the old wood, the disease travels from the fruit into the stem through the stem of the pod. That does not occur in Hevea, or at least, the fungus does not travel from the fruit, down the branches, into the main stem. I am often asked why "canker" should occur in districts where there is no cacao? Well, why did it ever occur on cacao? There is no doubt that it is a native fungus, and I believe that it is identical with the species which attacks Breadfruit, but that point has not been proved by infection experiments. Another similar fungus attacks arecanuts in South India, but Coleman has proved that that is not the same as the one on cacao. The

METHOD OF TREATMENT

advised in 1904 remains the only possible one. The diseased cortex must be cut out and burnt. Where the disease is discovered in an early stage, before it has penetrated right through the cortex to the wood, it is sufficient to scrape or cut off the cortex until healthy laticiferous tissue is reached. Such scraping can be done with a piece of hoop iron. If all the disease could be discovered in that stage, it would do very little damage. Where the wood beneath the patch is discoloured a thin shaving might be removed, but I do not think it is worth while to cut away much of the wood: cutting away the wood, if done smoothly, will not do any harm, but in all probability it is not worth the time. In cases

where the treo has healed itself, that is, where the cankered bark is scaling off, all scales of dead bark should be shelled out. The fungus in those scales is dead, but there may be resting spores there, and I have seen cases in which the disease has commenced again under the old scale. Of course, that may have been a reinfection ; water lodges behind these scales, and in that way they form admirable points of attack for the fungus. It is often necessary to cut away any healthy bark in such cases; the scales shell out, and that removes all the dead diseased tissue. It would be well to paint the wounds with Bordeaux mixture, made according to the usual formula. If the wound does not extend to the wood, there is no necessity to cover it with anything : the tree very soon forms a protective layer of cork over it. If the wood is exposed, the wound should be covered with cowdung and clay. Very large wounds should be tarred in the middle, and plastered with cowdung and clay round the edges. We are badly in need of some protective which can be applied to exposed wood without injury to the surrounding healthy bark. Tar undoubtedly kills the surrounding bark and to some extent retards healing ; consequently, I do not think it can be safely applied to small exposures on the tapping surface. There appears to be some hope of success with the sediment from Bordeaux mixture, made adhesive by means of a resin compound. At present, I should advise painting small wounds with Bordeaux mixture, and then covering with cowdung and clay. When the wood has begun to decay it is often difficult to keep out boring beetles. Some flowers of sulphur mixed with the cowdung and clay will prevent their attack to some extent. Some planters have used kerosene or bulk oil for that purpose, but my experience is that all oily subtances soak into healthy Hevea bark and kill it. The treatmont described

MUST BE ADOPTED IN ALL CASES OF CANKER.

The only other point is whether anything can be done to *prevent* the attacks of the fungus. The fungus attacks the fruit, and may be expected to do so every wet year. It is impracticable to treat the fruit ; but after a serious outbreak of the fruit disease, fallen fruit should be collected and burnt. It is rather a matter for congratulation that tapping, so far as the evidence goes, reduces the number of fruits. Some years ago a planter patented a latex protector, intended to prevent rain water falling into the cups. More recently a rain gutter has been brought out, to prevent the rain water running over the tapped surface. The patentee of the latter claims that he can continue the tapping through the wet weather and obtain more rubber per annum. Its chief recommendation from the present point of view is that it stops the constant flow of water down the stem from the crown, and in that way may prevent decay on the tapped surface, and canker. The germination of any fungus spore depends upon the presence of moisture, but in the case of *Phytophthora* is especially necessary that the sporangium should fall on a wet surface. If the stem could be kept dry, there would be practically no canker. Of course, I know that it is impossible to keep the stem dry, owing to the lateral drive of the rain, but these rain gutters would keep off some of the water. I am strongly of opinion that it would be worth while to experiment with these on a fairly large area. I have already

INSTITUTED SPRAYING EXPERIMENTS

with Bordeaux mixture. Our chief aim should be to protect the potential tapping area from canker, because the wounds made in excising diseased bark interfere with future tapping operations ; and the best method of protection would be to spray the stem in the dry weather just before the monsoon to a height of six or eight feet. I recommended that to South Indian planters for several years as a preventive of "Pink Disease," and it has now been carried out at a small cost. There is no doubt of its efficacy against any fungus which attacks the tree above ground: the only question is whether it will have any effect on the rubber through traces of copper compounds washing into the latex. Experiments have been begun to decide that point. Bordeaux mixture dries on the tree, and the copper compounds, which are gradually dissolved by the rain, kill the fungus spores which may alight on it. The amount of copper on the tree is very small, and the quantity brought into solution at any given time is infinitesimal. Hence it would seem improbable that any appreciable quantity would get into the latex. Rough barked trees appear to be attacked by canker more than those with a smooth bark, and the deposit of Bordeaux mixture in the cracks would be an effectual preventitive. Spraying does not increase the proportion of scrap, nor does it stain the rubber, but I must wait until the rubber has been analysed before deciding whether it can be unreservedly recommended. In case spraying can be recommended, the following details may be given now. Solutions containing copper compounds must be made in wooden vessels. Only a few weeks ago I came

across an instance in which the copper sulphate was being dissolved in an iron cauldron : if that is done the mixture contains no copper at all and is quite worthless.

THE QUESTION OF SPRAYERS

is a difficult one. In a case like this, where it is desired to put as little copper as possible on the tree, sprayers must be used : if the mixture is applied with a brush too much is put on. Moreover, it takes a long time to paint a tree, whereas the stem can be sprayed in less than a minute. The type of sprayer generally used in temperate climates consists of a tank filled with the liquid which is pumped out as required ; the operator carries the sprayer on his back, pumps with one hand and directs the jet with the other. This is undoubtedly the best type ; but it has always been stated in Ceylon that a cooly will not work with both hands. The Four Oaks sprayer is of that type ; and as it has been strongly recommended in Southern India, it seems probable that that cooly difficulty has been exaggerated. Another type of sprayer is filled under pressure, and the cooly has only to direct the jet. But the sprayer of that kind used in Ceylon is not a success. As the liquid is under pressure, the slightest defect in the fittings of the jet results in excessive waste, and as much falls on the ground as is put on the tree. There is no means of agitating the liquid in the tank, consequently the copper compound settles and cakes at the bottom ; and as the pressure falls, it fails to drive out a large proportion of the liquid. But the most serious objection is that more than half the cooly's time is taken up with the process of refilling. With the ordinary sprayer the liquid is simply poured into the tank, an operation which takes less than a minute; but the pressure sprayer requires anything up to a quarter of an hour. There is another type of pressure sprayer in which the liquid is poured in, and the pressure obtained by pumping in air, that is less objectionable, but with regard to waste it is as unsatisfactory as the othor. Whatever sprayer is adopted, it should bo capable of being taken to pieces, especially the pump part of it. Personally I consider that the best apparatus is a Deeming pump fitted on a small barrel. That requires two coolies, but a greater quantity of the mixture can bo taken, and less timo is wasted in refilling. The jet should be of the Vermorel type. The straight jets used in cacao spraying were made under a complete misapprehension of what was required in spraying operations.

COLLECTING SPOUTS SHOULD BE REMOVED

before trees in tapping are sprayed ; if they are not, the latex collected immediately afterwards will be far more likely to contain copper compounds. (Laughter.) Finally, I may once more urge the necessity of training two or three coolies to detect canker, and to treat it when it first appears. It is not a disease to be alarmed about, provided that it is treated in the early stages. I am confident that on the majority of estates, a sanitary gang would quite repay its cost. The cooly proved quite efficient in detecting and treating cacao canker, and there is no doubt he would be equally capable of dealing with the same disease on Hevea. It was suggested, eight years ago, that the mycologist should inspect every rubber estate once a year. That, of course, is physically impossible, if tho inspection is to be of any value. Moreover, it is not the work of a mycologist, A mycologist has to investigate a disease, discover the cause, and prescribe remedies ; and when he had finished one, there are always others awaiting attention. If his time is taken up with the inspection of known diseases, investigation ceases. To a great extent, the two duties are incompatible, and in any branch the investigator can only inspect for the purpose of extending or completing his investigations : he inspects to obtain knowledge. What estates want is not a mycologist so much as an inspector who is fully acquainted with all the known diseases and can advise as to treatment. When the inspector discovered any disease which was new to him, he would bring it to the notice of the mycologist for investigation. (Loud applause.)

The CHAIRMAN :—I am sure we are very pleased for Mr Petch's remarks. Things have been put in a very interesting manner, and will be of very great value in enabling us to detect any canker or disease that we see on our rubber treos, and when detected will enable us to check its growth. This lecture will be reported in the papers fully, and so we shall be able to see it all there and be able to keep it and refer to it in the future. It will be of very great value to us. I should like to propose a most hearty vote of thanks to Mr Petch for having come here today and given us this most interesting lecture. (Hear, hear, and applause).

Mr PETCH—bowed his thanks, and later on dolivered *impromptu* talks to an assemblod few on the "Pink" disease.

THINNING-OUT HEVEA ESTATES.

OPINIONS OF LEADING AUTHORITIES.

Quite a large number of estates are now commencing tapping operations, and are therefore in possession of trees four years old and upwards. A large proportion of these areas were planted in 1906, 1907 and 1908 in the respective countries, and the problems now before planters are of a varied character. In Ceylon, where, owing to soil and elevation, the trees were planted closer than in Malaya and Sumatra, some 60,000 acres were planted in 1906 and 50,000 acres in 1907; in fact those were the most active years of rubber planting in that island. Frequent distances at that period were 15 by 15 feet, or 20 by 10 feet; these represent spacings which would be properly described as close planting in Malaya or Sumatra, but they are not necessarily so on poor soil at an elevation of 1,000 feet and over above sea level. It is only when the trees, in Ceylon, reach their sixth or seventh years that thinning out on a large scale is forced upon planters; elsewhere on estates where the same distances have been adopted thinning out has been commenced at a much earlier age.

In Malaya, as in Ceylon, large areas were opened in 1906, 1907 and 1908. In 1906 the acreage was 99,000, in 1907 179,000, and in 1908 241,000 acres. The distances adopted in those years were a little wider than in Ceylon, popular spacings then being 12 by 24, and 18 by 18 feet. The same applies to Sumatra, except that many of the estates there being under Liberian coffee, a wider distance, especially 20 by 20 feet, was commonly adopted.

ACREAGES REQUIRING THINNING-OUT.

The broad fact remains that in Ceylon there are about 100,000 acres, and in Malaya and Sumatra a further 200,000 acres which are now covered with trees, the branches and root systems of which are in frequent contact and already competing with one another for light and soil. During the next year or so the problem of thinning-out must be faced: otherwise there will be a gradual reduction in yield of rubber consistent with a slower rate of growth of the whole plant and poorer bark renewal.

The problem can be easily settled by those parties who would simply reduce the number of trees by half; but such a policy would, on many estates, be unscientific and extremely wasteful. Thinning-out must be taken in hand only after the fullest consideration has been given to distances, soil, climate, diseases, storms, past tapping, manuring and general methods of cultivation. We will therefore study the methods generally adopted and the importance of some of these factors.

METHODS NOW ADOPTED.

Let us first admit that thinning-out must be done now or in the near future. Where thinning-out is resorted to on young areas the plants can be easily uprooted and destroyed, since the quantity of rubber obtainable from the stumps (or first eight feet) does not come into serious consideration. This is by far the most preferable course, and should in Malaya and Sumatra be done when the trees are about three years, and in Ceylon when they are about one year older. At the ages indicated the remaining trees can usually be expected to give a fair cover to the ground and to rapidly throw their roots into the soil set free during the thinning-out process.

On old estates the quantity of rubber obtainable from the stumps of trees being thinned-out is quite considerable, and immediate uprooting and destruction is therefore not generally deemed advisable.

On both young and old estates, and specially the latter, there are two methods available. The first is by cutting out all the trees in every alternate row; the second by removing only the backward trees. The first method is the easiest, most drastic, and most heart-breaking; it is based on the idea that in thinning-out half the trees must be removed. If an estate were closely planted and showed very even growth it would be perfectly justifiable; if the reverse conditions prevailed, then it is quite conceivable that complete good rows may be removed and bad ones retained, or that those lines of trees removed might possess the best trees on the estate, and those retained the worse on the property. Where the estate is not even, or where there is liability to death by various causes, thinning-out by the second method—removal of backward trees—seems to be the most sensible one to adopt.

HOW MANY TREES PER ACRE?

But even this policy has its limits. It is quite obvious that there is a minimum number of trees per acre to be kept in view. And he is a very wise man who can hit off that number. Our view would be to ultimately thin-out down to about eighty or ninety trees per acre; this would naturally be still further reduced from year to year through diseases, storms, bad tapping, etc. Diseases would be the most potent factor in effecting reduction later on, the thin-

ning-out process being of such a nature as to encourage the spread of fomes and white ants. On an estate known to the writer tho deaths amount to from 5 to 7 por cent, per annum ; the percentage common to young estates would probably be maintained or exceeded in the first two or three years following thinning-out.

While it is hardly fair to expect planters and experts to maintain the same views for all time, wo certainly feel justified in giving publicity to the opinions expressed by such men as Malcolm Cumming, Francis Pears, and Gallagher.

Cumming believed that close-planting would, during the first few years, give more rubber per acre than wide-planting.

The late Francis Pears stated that "an acre of rubber with 50 trees is likely to prove more valuable than one with 200." It will also be remembered that Wickham advised 40 trees per acre as against Berkhout's 300.

Gallagher estimated that on virgin jungle land from 15 to 20 per cent. of the trees originally planted would be lost by the time the trees were seven years old. He recommended commencing with 120 to 140 trees per acre, in order that about 100 trees per acre might remain at seven years.

Manuring and Thinning out.

While every planter must now admit that close planting checks the growth after the fourth or fifth year on fairly good soil, and that the original cannot be the final distance on estates planted only with Hevea trees, we doubt whether the actual value of manuring has been taken into full consideration. It has a direct bearing on the age at which Hevea estates should be thinned. There are many estates which, being closely-planted and therefore renewing their bark slowly, could be assisted by the application of manure. On many estates which have been too severely tapped the application of manure has been followed with a more rapid bark renewal; on closely planted estates a similar effect should be obtained. In some cases it would be advisable only to manure those trees intended to permanently occupy the land. Again, one might support a larger number of trees, per acre, by proper manuring.

How Thinning-Out is Done.

When we come to the actual thinning-out process we find that either the plants are felled near the ground and the stump and roots extracted, or the tree is cut off at a height of about eight feet. Where the basal part of the trunk is retained it is customary to tap this drastically and finally uproot. In one or two years a few pounds of rubber are obtained from each stump. Special gangs of inferior tapping coolies are usually entrusted with such work, it being desirable to employ only the best coolies for tapping the permanent trees. The writer has seen many stumps treated in this way and has been struck with their manifestations of vitality under such adverse circumstances ; even though tho stumps are densely shaded by the foliage of the surrounding trees, they may throw out numerous branches at the top, which, if allowed to grow, would probably give the plants another lease of life. If, however, thinning-out is to be done properly all such stumps must be uprooted, all roots removed, and every particle burnt immediately. It is true that by allowing stumps to retain branches the plants are kept alive and the risk from disease for the time being postponed ; sooner or later all traces of the trees so treated must be removed and destroyed.

Leading Opinions.

We have submitted the above to leading directors and planters, and have pleasure in giving the views of many who have already complied with our request. Our readers will notice that the opinions given below are those of planters in various parts of the East and of directors who have a personal knowledge of Eastern conditions and of administration from this end. At a later date we shall give a résumé of the various views now published.

Joseph Fraser Esq. (Ceylon).

In good soil favourably situated I prefer planting 20ft. by 20ft. in Ceylon, but over considerable areas I would plant 20ft. by 10ft., then cut out at 7½ to 8½ years old all inferior trees in a line 10ft by 10ft. Meantime I would manure highly while the prices remained at an average level of 3s. per lb. Trees of inferior growth I would remove at 3 to 4 years of age. In fields planted 10ft by 10ft. I would thin out to 20ft. by 10ft. at 3½ to 4½ years of age and manure heavily.

If the trees are even I would cut out the alternate line entirely, but if the growth is uneven I would go in for selection, and reduce the number of trees per acre to about 150. I would entirely remove trees that are cut out.

R. W. Harrison, Esq. (Klang.)

Your letter of the 15th inst. has been following me all over the country.

In reply to your queries ;—

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(1) The number of trees to be aimed at is from 90-100, and I should advise thinning to less than 115-120, in view of inevitable loss later from storms, diseases, etc.

(2) Remove backward trees in the first instance; if this does not reduce the number sufficiently, careful selection should be made, care always being taken to leave the healthy, well-grown trees.

(3) Trees should be uprooted. I have tried pollarding, and do not think it at all satisfactory.

I am by no means sure that by scientific manuring considerably more than 100 trees per acre can be grown.

VICTOR KINLOCH, ESQ. (JERAM ESTATE.)

I have read your notes on thinning-out Hevea estates very carefully. The desired average number of permanent trees per acre to be aimed at is, in my opinion, about 80, but the thinning should be done by degrees, and not all at once. The thinning-out process could be spread over a period, say from 2 to 3 years, in a case where a large number of trees are to be removed, and when the thinning-out process has been left till the trees are in bearing. This method would save the expenditure of a large sum of money in one year, and allow for the payment of dividends during a period when incomes are likely to be still small. Moreover, during this period trees which yield the smaller quantity of rubber or are deformed or backward could be picked out, leaving only the healthiest and strongest plants.

The entire and immediate removal of whole rows, is, in my opinion, unnecessary, and far too drastic, and leaves no margin for further reduction by diseases, etc. When thinning is to be carried out, the whole tree should be removed, and not merely pollarded; such a tree would require constant pruning, and is at the same time taking goodness out of the soil which would otherwise benefit the adjacent trees. On the removal of a tree it should be burnt at once, or taken to the lines by coolies for fire-wood, the latter method being preferable, saving the cost of cutting up and burning. On estates planted 12 by 24 feet I would advise thinning down to 100 trees an acre, which leaves a margin of 20 trees per acre to allow for deaths from unavoidable causes.

Manuring is a subject that I know very little about, and I do not see the necessity of such an operation on estates on virgin soil and periodically forked over; provided, of course, that the

soil is naturally rich, and which I think is the case on most estates in our district.

D. Douglas, Esq. (Province Wellesley.)

Your remarks on the thinning-out of closely planted rubber trees came duly to hand.

The three main points I will answer.

(1) In thinning-out rubber trees I would leave about 100 trees per acre.

(2) I would remove all trees of poor growth for age, trees with burrs growing on them, and any trees which show the effects of bad tapping, but so as not to reduce the number to less than 100.

(3) Before completely removing the trees I would stump them to about 8 or 10 feet, tap the stumps heavy for about 9 months, then uproot them, carry off as much as possible of the wood; or where vacant spaces can be found, burn in small heaps.

I am of opinion that where rubber plantations have been planted too closely no thinning-out should be done until the trees are about 10 years of age. I consider that anyone thinning-out earlier would be throwing away a good deal of valuable rubber, and would be removing trees, which until that age were not interfering to any great extent with the growth of the rest of the plantation. White ants and disease, with wind storms, are sure to reduce the number by about 2½ per cent. yearly.

Where trees in the past have been planted 10 ft. by 10 ft. or 12 ft. by 12 ft., I would recommend thinning-out at the earliest opportunity; any greater distance apart I would delay the cutting out until about 10 years of age.

I am not in favour of reducing the number of trees to what might at the present time be considered a standard number.

A. Bethune, Esq. (Federated Selangor)

The points you mention are undoubtedly among the most important of those now occupying the attention of all thoughtful planters, and in several of the companies with which I am connected we are carefully investigating them.

I find myself in general agreement with your views and suggestions, but I am sorry that at the time of writing I am not in a position to express any views sufficiently definite to be of any use to others.

Messrs. Harrisons and Crosfield.

It seems to us that the question of thinning-out trees is one which it is very difficult to generalise in. Local conditions must affect it very considerably, but no doubt it is a question which a good many estates will have to face.

M. Sidney Parry, Esq. (F.M.S. Rubber Co.).

I have read with great interest your article on "thinning-out." My last trip to the East convinced me of the justice of your remarks, and, as I said in my report to another body, I am going back to a belief in 30 ft. by 30 ft. as the ideals we originally started on the F. M. S. Rubber Co., 40 ft. by 40 ft. And I am under the impression that the yields from those trees interplanted years later are even now far below the average of the original plantings. Anyone who looks at the old trees on Welds Hill, Linsum, etc., must be convinced that our 15 ft. by 15 ft., 18 ft. by 18 ft., etc., are far too near for the future. Admitting that at first better average yields are got per acre from the closer plantings, one has to answer your three points. (1) I would aim at 30 ft. by 30 ft., in the meanwhile pollarding and tapping the trees to be eventually removed.

(2) I would follow a regular system both for supervision purposes and because it seems to me the only way to grow an even plantation.

(3) By pollarding and tapping the trees to be cut out some returns will come in.

I would start a plantation 20 ft. by 20 ft., and even then eventually thin-out.

Hon. Everard Feilding (Kuala Lumpur).

I am not a technical planter, and have no experience to enable me to answer, except from my second hand information, your questions. I return your proof marked, however, and from the depth of my ignorance make the following comments.

(1) Agreed that each estate's condition should be studied; in up-country land closer planting in early years is more practicable than in low land,

(2) Mr Skinner wrote me very recently that he is now quite satisfied that (for his conditions) 20 ft. by 20 ft. is the right thing to start at, but that cutting out is afterwards necessary, by selection of the bad trees, and not regularly.

(3) He pollards and taps the pollarded stumps before removing them.

(4) I *think* Mr. Skinner would agree with the late Mr Pears.

(5) Mr Skinner is strong on the point that these pollarded trees should be tapped as carefully as the others on two grounds: (1) That you don't

get more rubber by careless or deep tapping; and (2) that the coolies get into bad habits, and that the strictest rules must be observed with all trees with the object of training them correctly.

(6) I thought that *Fomes* spread as much along live roots as along dead ones. And also that unless a *source* of *Fomes* is already present there was no chance of its arising spontaneously even in dead stuff.

[*Fomes semitostus* generally commences on dead roots as a saprophyte and continues on living material as a parasite.—Ed. "J.R.J."]

H. M. Alleyn, Esq (Ceylon).

You are tackling the most difficult planting problem there is.

Number of Trees.—I think that at 8 years the number should not exceed 100 to 120 per acre, and at 10 years 75 tree per acre, variation allowances according to soil, climate, and growth to be made.

Method of Thinning, etc.—I should adopt a square system, i.e., I would take blocks of, say, 4 lines and 4 trees, i. e., 16 trees in all, and cut out a definite number of the weakest trees each year. Vacancies to be counted as trees. If trees cut out are in bearing they might be sawed across at 10 ft. or so. The stumps tapped all over every two or three days for three months, and then finally pulled out by mechanical lifters, jacks, or chains, or any other means,

The taking of trees in blocks and the selection of the weaker trees therein would operate much the same as selection in use in English forestry, etc. To detail the process (a) Mark out each block by wooden pegs; (b) select your trees for destruction and mark them with whitewash; (c) when passed as correct by superintendent, put in the sawyers or axemen.

If trees are 200 per acre, and age is six years, then 80 to 100 have to cut out over two years, i. e., 40 to 50 per annum, or 20 to 25 per cent. for each year, counting vacancies and cut outs as trees. Thus if 25 per cent. has to be cut out per annum, then blocks of 16 trees should be taken, i.e., four lines by four trees, if 20 per cent. has to be taken out each year, then blocks of three lines by five trees might be taken, and out of each 15 trees in a block (including vacancies) three trees might be cut out per annum. This may in certain cases tend to develop clumps or groups of trees. Growth in clumps does not appear to be retarding to the trees, provided clumps are small, as in such case the trees obtain the necessary sunlight.

J. C. Tate, Esq (Langkat Sumatra).

I read your notes on thinning-out with great interest.

With reference to the thinning-out of closely planted areas, I am of the opinion that it would be a bad system to remove alternate lines whatever distances the trees were planted. I think the right line to take is the removal of the weaklings and badly grown trees, thus giving light and air and growing space to the surrounding trees. During my recent visit to the East I strongly advocated this system to the managers, and advised the spaces being left unplanted where the ground was prepared for supplies.

I think that it would be useless to put in a supply unless there is *radius* of at least 40 to 50 feet.

This part of the planters' work struck me as particularly open to censure, for what I saw of supply planting showed that they disregarded the first rudiments of forestry, viz., the dominanating and dominated tree.

Again, in thickly planted areas, the removal of trees should be done gradually, so that those remaining should not be exposed to strong winds or rain storms before they have got a firm hold of the ground, and accustomed themselves to stand alone. No doubt we should not like to see a less number of trees than 70 to the acre, and I do not think that a carefully planted and tended acre of 100 trees should get below this figure, say, in 10 years. I rather prefer a planting distance of 30 feet by 15 feet than 20 feet by 20 feet, as the former, in my opinion, gives a sturdier tree.

Since I have been connected with the rubber industry I have advocated 5 to 10 acres being planted yearly (where extension work has been stopped) to make up for losses by diseases and storms. The planter should carry out such work with special care, and in this way a fine addition would be made to the planted area making up for losses in the older areas.

Of course, it will be understood that I am referring to supplies planted in three-year old rubber and more. I see you advocate taking as much rubber as possible from the tree before removal. I should be inclined to disregard this advantage to the crop on the grounds that little or nothing would be obtained from those trees which are to be cut out, for only the weaklings and sapling supplies would be removed. Managers should be instructed to take out all roots and leave the ground perfectly clean and the trunk, branches

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and roots should be burnt. On many estates I noticed branches of rubber trees and bits of stumps lying about instead of being carried out and burned.

E. G. WINDLE, ESQ. (SOUTH INDIA).

The following represent my ideas on thinning-out Hevea estates:—Take as a basis a first class property, planted 18 ft. by 18 ft. (equals 130 trees per acre), producing at 4 to 4½ years. The first thing to settle is when to begin thinning, and consequently on what method. I would not start it until the trees had been tapped for, say, two years, as I certainly agree that during the first few years close planting, i.e., 130 trees v. 40 or 50, gives more rubber per acre than wide planting, and I would tap steadily in the usual way until the trees were, at any rate, between six and seven years old. Probably the date for thinning-out will be determined to a great extent on the trees attaining a certain yield per acre. When thinning starts, I would commence with backward trees and bad tappers, but this method would be insufficient of itself, as the best growing parts of the estate would be most in need of thinning. Consequently, the first method would have to be supplemented by judicious selection, evidently the lining could not be kept to, though it would of course not be interfered with more than could be helped. Trees that were unhealthy or bad tappers I would take out by the roots at once. Where growth was heavy, the crown of the tree might be cut, and a circular trench cut some 6 ft. or so from the stem, cutting through all roots for a depth of 15 in. or so, and the stem tapped as heavily as possible for a couple of years before final extraction, the necessary sucker growth being allowed to keep it healthy. As to the average number of permanent trees per acre to be aimed at, I would put this at 50, and would aim at arriving at this number when the plantation was, say, 12 years old, commencing thinning at 6 to 6½ years. This would only mean a reduction per acre of 10 per cent per annum. The above may appear too slow a process from the point of view of the best development of the trees, but is, I think, a reasonable compromise between development and dividends.

As to manuring closely planted estates. No doubt the application of manure results in a more rapid bark renewal, but as this can only be effected if the trees have good heads of foliage for which space is required, manuring must lead to more speedy cutting out than would otherwise be the case. I am, of course, in favour of it.

W. F. DE BOIS MACLAREN, ESQ. (SERDANG CENTRAL.)

I am in receipt of your leading article on the subject of "Thinning out Hevea Estates." In this article you take it for granted that plantations in the East, as a general rule, require thinning out. You do not, however, state why this is the case; but the reasons are very obvious to anyone who has an observant eye, and who visits leading estates in say the Klang District of the Federated Malay States.

One visiting that district hears general complaints of the bad renewal of bark on trees

being tapped, and one also hears of hundreds of acres of old rubber being rested on many of the leading estates. One sees gloomy aisles of closely-planted rubber trees. Between the rows of the trees light never penetrates, and the soil is always shrouded in darkness. The foliage of such trees is poor as a rule, and is often limited to a mere crown at the top of the trees. Owing to the lower branches of the trees receiving no light, there is no foliage upon them, and thus deprived of their function, they decay and fall off.

Drastic thinning out of rubber trees is going on on quite a number of the leading plantations. On some estates, from 50,000 to 70,000 trees are being cut out. It is now freely admitted by many of the leading visiting agents that 40 to 50 trees to the acre might be the best number, and at any rate about 70 trees to the acre is the largest number that should be planted. If thinning out is to be done, there should be no half measures about it. Once decided upon, the quicker it is carried out, root and branch, the better. When I state root and branch, I mean literally, and do not approve of simply pollarding the trees, or topping the trees and letting the trunks remain in the ground, in order to get some additional rubber out of them. The roots and trunks should be entirely removed as quickly as possible, in order that the roots of the remaining trees may have a chance to extend, and that the ground may receive some cultivation.

When thinning out the rubber trees, I do not think that too much importance should be attached to the necessity of preserving a good tapping line of trees. First of all, poorly-grown, mis-shapen trees should be marked for cutting out. When these have been removed, then all bad-yielding trees which remain might also be eliminated. Thereafter, one can stop to consider whether it is advisable to still further reduce numbers or not. The difficulties of thinning and getting rid of roots are not inconsiderable, and there is, of course, the danger of disease from decaying roots, if these are left in the ground. After all, however, the roots of Hevea, especially in such closely-planted estates, are comparatively small, and not like those of many of the larger jungle trees.

It is impossible in the course of a letter to do justice to this subject, but the foregoing may be taken as a brief epitome of my opinions on the subject.

C. E. Welldon, Esq.

I am inclined to think that in Ceylon and South India 120 trees an acre is not too many, except on exceptionally good flats, and in Malaya and Sumatra 80-90 trees per acre.

From all I hear it is difficult to get trees thinned out, unless you leave it to the selection of the Superintendent, and allow him to uproot the weaker trees and the trees that are yielding the smallest quantity of rubber.

Theoretically, I should be inclined to say, in rubber planted 15 by 15 or 17 by 17 it would be better to take out the alternate rows, and the alternate trees, leaving the clearing 30 by 30 and 34 by 34 respectively; but, practically, I think it wonld prove the best in the long run to leave the Superintendent to exercise his own judgment.

I advise lopping up the trees well, and then tapping them drastically for several months, prior to eradicating them.—*India Rubber Journal*, Sept. 4.

USEFUL TREES.

The "breadfruit" of Ceylon is a remarkable tree. Its fruit is baked and eaten by the natives as we eat bread, and is equally good and nutritious. In Barbatu, South America, is a tree which by piercing the trunk produces milk, with which the inhabitants feed their children. In the interior of Africa is a tree which produces excellent butter. It is said to resemble the American oak, and its fruit, from which the butter is prepared, is not unlike the olive. Park, the great traveller, declared that the butter surpassed any made in England from cow's milk. Sierra Leone has a tree which produces cream fruit, which is agreeable to the taste. At Table Bay, near the Cape of Good Hope, is a small tree the berries of which make useful candles. It is also found in the Azores. The vegetable tallow tree also grows in Sumatra. In the Island of Chusan large quantities of oil and tallow are extracted from its fruit, which is gathered in November or December, when the tree has lost it leaves. The weeping tree of the Canary Islands is a kind of arboreal freak. This tree in the driest weather will rain down showers from its leaves, and the natives gather up the water from the pool formed at the foot of the trunk and find it pure and fresh. The tree exudes the water from innumerable pores situated at the base of the leaves.—*Weekly Gazette*, Aug. 30.

HEVEA RUBBER EXPERIMENTS AT HENERATGODA.

BULLETIN BY R. H. LOCK, ScD., F.L.S. AND M. K. BAMBER, F.I.C., M.R.A.C.

The first bulletin issued under the auspices of the newly formed Department of Agriculture, is devoted to the Heneratgoda Experiments for 1911-1912 and has been prepared by Dr. R. H. Lock and Mr. M. Kelway Bamber, who have been in charge of them. Two other bulletins, dealing with the subject have been issued already and the present forms part third of the series. The present circular covers the ground for 1911 and the first four months of 1912. The experiment is still a long way from completion and the present communication is to be regarded only as an interim report. The experiment consists in the tapping of seven rows of ten trees each, all being treated alike, except that each row is to be tapped at a different interval of time. The trees used in the experiment were approximately twenty-five years of age, and had not been tapped previously for some years. A table giving the average circumference of each set of ten trees in June 1908 and June 1912 shews only a small increase in girth, ranging from an average of ·65 inches to an average of 1·48, which is put down by Dr. Lock and Mr Bamber to close planting. The system of tapping was as follows :—The bark to a height of six feet was divided into four equal areas, each extending half way round the tree. Each area was occupied by three V-shaped cuts. The four areas were tapped in succession—first the lower half of one side, then the lower half of the other side, followed by the two upper areas in the same order. The tapping was not very successful and on June 8, 1911, an important change was made in the method. Before this date the trees were pared with the Bowman-Northway knife and immediately pricked with the sharp pointed spear pricker. From June 8th onwards the paring knife was used alone, without the pricker, the paring cut being made slightly deeper. All the experiments, we are told, made both at Peradeniya and Heneratgoda, point to the superiority of the method of paring over that of combined paring and pricking, In fact several trees of the present experiment were showing signs of injury which are believed to have been occasioned partly by the method employed.

The new method of paring only was followed by a marked increase in yield towards the end of 1911, but probably only a small part of the increase can be attributed to the new way of releasing the latex. On the other hand, the usual seasonal increase was emphasized in 1911 by the fact that the climatic conditions were exceptionally unfavourable for a good yield during the first half of the year, and, during the second half, unusually propitious. In addition to this, Dr, Lock and Mr. Bamber have every reason to believe that the stimulus of three years' tapping had by this time led to the production of new layers of laticiferous bark, possessing a markedly enhanced capacity for latex formation. This view, derived from a comparison of the yields of the different rows at different seasons and stages of tapping, is confirmed by the yields obtained from the renewed bark of the old tree.

As in previous Circulars, the results of the experiments are set forth in a series of tables. The annual yield varies from 1·2 lb., with tapping at an interval of 9 days, to 2·85 lb. with tapping at an interval of 1·4 day. These yields are, we agree with Dr. Lock and Mr. Bamber, extremely small for such old trees. A table giving the average yields per tapping in 1909-1911 shows that on the average the yield per tapping is lowest in April and May. The yield rises continuously until December and then steadily falls off again. The increase from April to December on the average of these three years, and taking the average result of various intervals of tapping, does not fall far short of 50 per cent.

The percentage of rubber in the latex, from month to month, is shown in tabular form. The only new fact of special interest which presents itself in this connection is the marked increase in the percentage shown by all the rows of trees at the beginning of 1912. Dr. Lock and Mr. Bamber think it will be convenient to postpone the further discussion of this phenomenon until further data are available. The most important new fact which has come to light during the past year of tapping lies in the increased yields obtained from the later tapping of the rows tapped at longer intervals.

On the subject of overtapping the bulletin has something interesting to say.

A strictly satisfactory definition of overtapping, it seems, has still to be devised. The problem has been, however, brought so prominently before Dr. Lock and Mr. Bamber by the facts recorded in the present bulletin, that it seems desirable to them to attempt a preliminary discussion of overtapping which may lead to a partial elucidation of the subject. Overtapping, they say, may be measured either by removal

of bark or by removal of latex. It is usual to discuss only the former kind of loss in this connection, but a tree can undoubtedly be overtapped by pricking only, without any removal of bark. In many systems of pricking the damage to the bark is at least as great as in the case of paring, and with the best possible pricking some damage is inevitable. Removal of latex without damage to the bark is in fact impossible, but, even if it were possible, there can be no doubt that there must be a limit to the quantity of latex which could be extracted without damage to the tree. The manufacture of latex necessarily uses up a certain amount of food and energy, and the supply of them in the tree is not unlimited. This is, of course, assuming that latex is not exclusively a waste product. The problem of the physiological effect of paring upon the tree is, therefore, a complicated one. Besides the rate of removal of bark, the amount of latex taken from the tree and the frequency of its removal has to be oonsidered. The real problem relates to the frequency of removal, but it is quite impossible to dissociate this effect entirely from the damage done by bark removal and the drain upon the resources of the tree entailed by latex removal.

In the present experiment some of the trees may be said to have been overtapped, because the whole of the outer bark has been removed up to the greatest height convenient for tapping, and renewal of the first and second areas tapped is still imperfect. The result is probably due, at least in part, to the use of the pricker, and the bark might have shown perfect renewal if the method of paring only had been employed from the outset.* In any case it is necessary to rest the trees from the point of view of bark renewal only. The two rows (I and II) have yielded at the rate of 770 and 650 lb. of dry rubber per acre annually for four years, which seems to be quite as much as one has any right to expect from close-planted trees in poor soil, whatever their age may be. Assuming a system by which the whole outer bark to a certain height is removed, a tree will certainly have been overtapped, says the bulletin, if the renewed bark is found not to be ready for tapping when the time previously assigned for such tapping comes round. From the evidence of the present experiment Dr. Lock and Mr. Bamber are inclined to extend the idea of overtapping somewhat further, and to assert that a tree may be overtapped although there is still a considerable area of original bark available for tapping. Thus, from the evidence alone they are disposed to draw the conclusion that one of the rows (III) was being tapped too rapidly, since the yield from the second of two similar areas is materially less than that from the first. From this point of view the tapping (even of row IV.) seems to be unsatisfactory, and a proper rate of tapping on the system employed is reached first in the case of row V. In the case of young and growing trees, planted with plenty of space, the authors of the experiment think that overtapping was taking place unless the second of two similar areas yielded decidedly more than the first. It is probable that the overtapping of row III. is associated with the poverty of the trees and their crowded condition, for the interval allowed for renewal in this case is between 5 and 6 years, a period which would undoubtedly be ample for trees which were widely spaced. Experience seems to shew that young and vigorous trees can be tapped at a rate which exhausts the available bark in four years, at the same time making good growth and giving a steadily increasing yield. At the end of the four years the first area tapped should be again ready for tapping. The results here obtained are regarded as a warning that there are strict limits to the recuperative powers even of Hevea. In fact, the Henaratgoda experiments may be said to endorse the view that, even in the case of the most vigorous trees, the period allowed for the first renewal should not be reduced below four years. The important point, however, is that, with light tapping steadily continued at intervals of from five to nine days, trees, although old and very closely planted, can be educated to give a greatly increased yield per tapping. The conclusions come to are as follows :—1. When Hevea rubber trees were tapped at different intervals on the system here described, the yield *per tapping* increased with the increase of interval up to an interval of about a week between successive tappings. 2. The yield *for a given period* was greatest at first from the trees tapped at frequent intervals. The relative yield from the trees tapped at longer intervals gradually increased until, after three and a half years' continuous tapping, the yield from trees tapped once a week may, at a particular season, become as great or greater than that from trees tapped at any shorter interval. 3. This conclusion is at present confined to the case of a particular plantation of trees, upwards of twenty years old, planted at a distance of only twelve by twelve feet.

*In the case of large wounds, caused by the death of the pricked bark, complete healing may be delayed for many years. Such damage should be distinguished from simple overtapping.—*Bulletin.*

TEA-PLANTING IN CEYLON.

Dear Sir,—I am thinking of going out to learn tea-planting in Ceylon. Could you give me a few facts about the work I should be required to do, and say what premium to pay? What should the salary be when I have been out there six or seven months?

Ceylon.

[It is not so easy to obtain appointments on tea plantations as it was formerly. In fact, there are far more chances for suitable young men on rubber estates in the East. Most of the tea plantations are owned by companies, and young men who have had experience in such companies' offices, are as a rule, appointed to posts on the estates—at least those who apply for such positions—and they are usually sought after by the junior members of the staffs. If a young man is proceeding to Ceylon with the intention of eventually taking up planting on his own account, he would most likely have to pay a fairly stiff premium to some planter, but he would require to have, later on, a considerable sum of money if he wanted to own an estate. We presume, in your own case, that you seek employment as an assistant, and unless you are connected with the tea trade we fear you will have some difficulty in getting into touch with the right people. We can, of course, supply you, under "Special Service" conditions, with a list of the principal tea importers, many of whom have their own plantations, not only in Ceylon, but in other parts.

The climate of Ceylon, though tropical, is comparatively healthy, the heat in the plains, which is nearly the same throughout the year, being much less oppressive than in India. Along the coast the annual mean is about 80deg., but this heat is usually tempered by a sea breeze. On most of the tea estates in the hill country the climate is healthy. The south-west monsoon prevails from May to September; the north-east monsoon from October to April. The rainfall varies greatly in different parts of the island, the driest averaging 30in. to 40in., and the wettest 150in. per annum. In the hills, as we have already indicated, the climate is excellent, and in the low country the European can keep his health if he is careful; but manual labour is practically out of the question for a white man, who finds his employment in sedentary pursuits or in the supervision of labour. With facilities for occasional change, the exercise of care and temperance, a young man would have every chance of keeping in good health. Life in Ceylon as in other tropical places, is practically passed in the open, so that vitiated air in dwellings is seldom a source of disease.

The life of an overseer or assistant overseer on a tea estate is a hard one, and as the nature of the work involves exposure to the sun and rain, there is, to some extent, risk to health. Again, the native will only work properly when his master's eye is upon him, and the constant watching and the long hours in the plantations are very trying, even to the hardened planter. Therefore, no one should go out to take up such employment who has neglected to be thoroughly examined by a competent medical man. Those ignorant of the overseeing of a big estate cannot realise the many duties which the man in charge and his staff have to perform. They are responsible for everything—the planting, rearing, stripping of the plants, the drying and packing, engagement of labourers and their payment, the commissariat, the accounts, and the many other items which go to the upkeep of the plantation.

We cannot recommend anyone to go to Ceylon with the object of such work in view, without first obtaining an appointment, unless he is well supplied with funds. The annual salaries run from 1,000r. for assistants of twelve to eighteen months' standing to 3,000r. to 5,000r. for men of experience. The present exchange value of the rupee is 1s 4d. As a rule, after three years, and sometimes five, according to the agreement made, a holiday is given of sufficiently long duration to enable a man to come home; but the question of long leave is generally arranged at the time of engagement. The cost of living for a European is difficult to calculate, the purchasing power of the rupee being about midway between its nominal value of 2s and gold value of 1s 4d, if local and imported purchases are considered together. It must be remembered that the standard of living for the European is higher in the tropics than in this country. Food locally raised is cheap. Meat, the quality of which admits of improvement, costs from 12c. to 40c. per 1 lb.; fish, along the coast and within easy reach of the railway, is very abundant and good; fowls and ducks can be procured at 25c. to 75c. each. Fruit is plentiful and excellent, and its daily consumption is recommended by the medical authorities. An outfit suitable for a young man proceeding to take up a junior position on an estate would cost about £35. —Ed.]—*Bazaar*, Sept. 13.

A NITROGEN FERTILIZER.

Colombo, 23rd September, 1912.

Dear Sirs,

With reference to the report published under this heading on page 86 in the July issue it will no doubt interest you to hear that this "Cyanamid" is identical with "Nitrolim" and that this article is already available in Colombo, where we stock it.

Experiments have been carried out and the results have proved highly satisfactory on tea. The results on other products will soon be available.

We are, Dear Sir,
Yours faithfully,
FREDUENBERG & Co.

THE FRUIT-GROWING INDUSTRY.

Following up our recent comment on fruit growing in various countries, we publish below an instructive article from the *Home and Colonial Mail* for August, giving interesting facts and figures from Rhodesia and Western Australia, which says :—

"The fruit-growing industry is attracting increased attention in all parts of the Empire where the cultivation of fruit is possible. It has been found that the Rhodesian climate and meteorological conditions are suited to the growth of the finest oranges and lemons, and the British South Africa Company, with a view to the encouragement of an industry which shows the greatest promise, have secured the services of Mr. C E Farmer, a practical grower of sub-tropical fruits, who proceeds to Rhodesia immediately in connection with the company's citrus plantations. As regards Western Australia an instance of how fruit-growing flourishes under irrigation is supplied from Wentworth, on the River Murray. This is a special case, it is true, says the correspondent recording it, but on the ground that what one man has done it is open to others to do, it affords a stimulating object-lesson. The figures, at least, are accurate and authentic. The trees and vines of this grower were planted in September, 1908. Last season 362 apricot trees yielded fruit, 57 cwt. 1 qr. 16 lb., valued at £168 19s. 1d., exclusive of bonus on export not yet credited. An area of 458 peach trees yielded in dried fruit 133 cwt. 2 qr. 6 lb., valued at £491 8s. 3d. A total of 1,640 currant and sultana vines yielded in dried fruit 125¼ cwt., valued at £236 14s. 8d. Large currants, with stones, and still raisins, have not been accounted for in this, and a bonus is also usually paid in addition. Thus the value of apricots was £168 19s. 1d., peaches £491 8s. 3d., currants and sultanas £236 14s. 8d.; total £897 2s. The packing-house charges amounted to £87 19s. 2d., leaving a balance of £809 2s. 10d. The return per acre for vine was £47 6s., for peaches £93 13s, and for apricots £38 4s. In addition, from two to three tons of fresh fruit were sold or given from the area, and a quantity of dried fruit was retained for home consumption and show purposes. The whole of these fruits were delivered at the packing-house within three years and seven months from the time the trees and vines were planted. Vines usually give a pretty full crop in their fourth season. This year, however, the crop was impaired by oidium. The peaches and apricots, of course, are not yet yielding a full crop. There is a promise of a fifty per cent. increase on these trees for next season. The grower in question has also a good many navel oranges on his young trees which have not yet been harvested.

FORMALIA AS A POISON FOR FLIES.

Prof. R I Smith, entomologist at the N. C. Agricultural Experiment Station in the United States, strongly recommends the use of formalin as a poison for flies. The method he has found most successful is the use of formalin in milk in the followings proportions :—

One ounce (two tablespoonfuls) of formalin. 16 ounces (one pint) of equal parts milk and water.

In this proportion the mixture seems to attract the flies much better than when the formalin is used in sweetened water, the method that has usually been recommended. The formalin-milk mixture should be exposed in shallow plates—a pint will make five or six plates—and by putting a piece of bread in the middle of the plate, it furnishes more space for the flies to alight and feed, and in this way serves to attract a greater number of them. Prof. Smith first used this poison in a milk room where the flies were very numerous, and poisoned over 5,000 flies in less than 24 hours, on several different occasions. Over a pint of flies were swept up in this room each time the poison was used. Another very conclusive test was made in a large calf barn where flies were extremely numerous. Six ordinary size plates of the formalin poison mixture killed about 40,000 (four quarts of flies), between 12 o'clock noon and 8 o'clock the next morning. This is only an illustration of what can be done by the use of formalin about stables where the flies are breeding. Prof. Smith points out that formalin is cheap as well as effective, and he believes it to be far more valuable than any of the many fly poisons so widely advertised in the United States. —(Quoted in "Malaya Medical Journal.")

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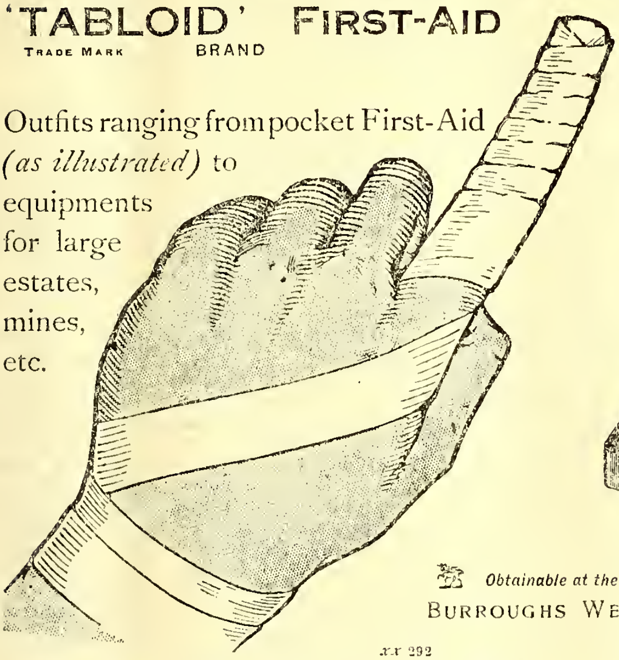

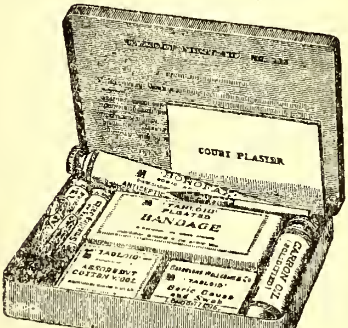

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THE VANILLA INDUSTRY OF THE SEYCHELLES.

In the preparation of vanilla beans in the Seychelles, a successful result depends on the pods being picked at the right stage of maturity more than on anything else—that is, when they are ripe and just before they begin to split. An unripe pod will never prepare well, and is always inclined to become mouldy; split or over-ripe pods have lost much of their value. A pod in condition to be picked has lost to a great extent its shiny green colour, has become duller, with an almost silvery appearance. The longitudinal lines along which it will eventually split, if left, are distinctly marked. The tip is light in colour, or even yellowish, and comes away fairly evenly from the stalk when broken off. Pods in a bunch seldom ripen simultaneously, so they must be carefully watched. When brought in, the pods are sorted into five qualities—(1) over six inches long; (2) over four inches long; (3) under four inches long; (4) split; (5) unripe, broken, etc. A vessel of water is heated to 188·6 deg. F ; the pods are placed in an open-work basket, and dipped for ten seconds, withdrawn, and allowed to drain for about five seconds; dipped again for ten seconds, withdrawn, and drained as before; dipped again for about five seconds, or until their colour has changed to a dark green. Large pods require a longer third dipping than small ones. After being scalded, the pods are wrapped in woollen blankets and left in a warm, dry place for twelve hours, when they have taken on a blackish hue. They are then placed in trays in a room heated to between 90° and 100° F., on one thickness of blanket, and covered by another. In about ten days the largest pods will have become wrinkled, the smaller ones before that. When in this state they can be removed to a cool drying room, where they are placed on trays uncovered, heaped on each other to a depth of three inches, and turned about every day. The more slowly vanilla is dried the better. When the pods are dry they are taken out and stored in a dry place in wooden boxes. They are examined thoroughly from time to time, to see that they show no signs of mould. A dry pod should have a silky feeling, the wrinkles must be soft, there must be no hard centres, and it should be possible to tie the pod in a loose knot without breaking it. Absolute cleanliness is observed all through the preparation, and those who handle vanilla are careful to wash their hands before touching it. When sufficiently dried, the pods are put into a vessel containing water at a temperature of about 80 deg. to 90 deg. F., and stirred with the hands for about five minutes, then taken out and placed in trays or on a blanket in the sun, where they soon dry. The pods are now measured and tied in bundles of sixty pods each, with two turns of flax thread in the middle only. Tin boxes are used in the Seychelles, thirteen inches long, nine inches broad, and six inches deep, a lining of parchment paper being placed in each. The vanilla must be packed fairly loosely, and the lid secured by solder.—*Royal Society of Arts Journal*, Aug. 23.

CINCHONA AND CINNAMON.

By T. Gardner, F. C. S.

CINCHONA.

Quinine and quinine salts showed a diminution in 6 months of this, as against last year, although the imports of quinine for the half-year 1,571,206 oz. in all, were 88,698 oz. more than during the same period of 1911.

A reference to quinine almost necessitates mention of its source, cinchona bark, commonly known as Peruvian bark, a drug of equal importance with opium. This, a drug of vice-regal institution, owes its nomenclature to the wife of a Viceroy of Peru in 1638, the Countess Chinchon, who through its instrumentality was cured of a fever. Its growth commercially can be traced from this incident, for soon afterwards it found its way to Spain, supposedly through the instrumentality of the Jesuits, who seemed to have been largely connected with the introduction of new drugs into Europe. Markham's expedition to Peru and Bolivia in 1859 resulted in the commencement of cinchona plantations in British India, in the Himalayas and Nilgherries. Prior to this, plants and seeds had been brought to Java by the German botanist Hasskari on commission by the Dutch. In this way the cultivation of the trees has become so extensive in India, Ceylon and Java that we are no longer dependent on its South American home for our supplies. For nearly a year the Java cinchona planters have been in negotiation with the European quinine makers, and have obtained from the manufacturers the concession they sought. This arrangement was ratified towards the latter end of July, the principal feature being that the quinine manufacturers have agreed to pay for a period of three years 5c per unit for bark. During the present year the unit price obtained for bark at the Amsterdam sales rose from 3·07 at auction 1 to 4·31 at auction 6, a somewhat noteworthy feature compared with the minimum and maximum unit prices at the 1911 auctions—namely, 3·03 and 3·22 respectively. These low prices were the direct cause of the negotiations referred to, which created considerable dissatisfaction amongst the Javanese planters, who, by way of retaliation, circulated a threat to manufacture on the spot quinine and export it, whilst the Government at the same time thought about doing likewise. The outcome of these threats was the despatch to Java by the European manufacturers of a director of the Brunswick Quinine Factory—Herr Buchler—who was empowered to offer the planters a considerable advance in the unit price on the condition the planters gave up their scheme of building a factory. The Government, however, still reserve the right to build and equip such a factory. Through the agreement it is hoped that an important industry, which was becoming unprofitable, will once more be worked on payable lines.

The cost of producing quinine in India is heavier than in Java on account of the Indian bark being poorer in quinine than the Java; indeed, during the past few years a good deal of bark has been imported from Java for the manufacture of quinine, although the Indian Government does not deem it necessary to make a profit out of either its cinchona plantations or quinine factories. Notwithstanding this, the cost of making quinine by the Indian Government is abnormally high.

CINNAMON.

The recent activity in planting rubber and in extending rubber plantations in Ceylon has given a serious blow to one of the important and old-established plantations of the country, cinnamon, to wit. Where the locations have been suitable planters have rooted up their cinnamon and planted rubber or coconuts instead, no doubt being led to do this by the prices obtaining for cinnamon, which have gone down to so low a figure as to scarcely pay for its cultivation. This has not been without appreciable effect on the market and accounts for the scarcity of bark offered at present. Probably a diminution of supply may cause an upward tendency in price, and hence stimulate its growth once more. The cultivation of the plant in the island dates back to 1770, when the Dutch instituted a profitable trade in the bark, actually controlling not only the supply but the price. When England came into possession of Ceylon the Amsterdam market suffered severely, and ultimately the trade passed to London. The cinnamon tree is indigenous to the island, and before its cultivation the Portuguese, on their occupation in 1536, exported regularly the bark which they collected from the wild plants. It seems a mistake that the cultivation should be gradually foregone, particularly as its competitor, Chinese cassia bark, is encroaching as a substitute, and is making such headway as to threaten the extinction of the cinnamon trade. This cassia bark is obtained wholly from trees cultivated in the south-eastern provinces of the Chinese Empire, and is a species of cinnamon. The oil it yields is similar but not the same as the oil from cinnamon. The mode of obtaining the two barks is slightly different. In the case of cinnamon the plant is cut down so as to allow shoots to grow. When these are about two years old they are cut off, trimmed of leaves, the bark removed, dried in heaps for 24 hours, and finally the outside bark is removed. With cassia, when the trees are six years old, the branches are cut, the twigs and leaves removed, and the bark planed and then made into bundles for exportation.—*Financier.*

THE COCONUT WARNING.

Now that we have the full text of the F.M.S. Government warning about coconut and copra speculations before us, we have nothing but praise for those who took the responsibility of giving it currency. The particular prospectus on which the warning was based was never publicly issued, but copies of it are known to have reached Malaya, though we have not been able to obtain one. It is but fair to say that the reference the warning contains is not to officers retired from the F M S Civil Service whose names may be said to be household words in Malaya. It would apply to them if they associated their names with a coconut or copra propo-

sition, but the particular prospectus we have in mind contained names which would have been absolutely worthless to the company promoter unless much had been made of the fact that the persons who bore them had been in public service. To our minds, however, the chief importance of the warning lies in the exposition which it gives of the policy of the Government. That policy is to protect the small holder against himself. By far the greater part of the coconut trees in bearing are in small groups owned by a few Malays or Chinese. To these people the acre or two represents a permanent income sufficient to keep them in comparative comfort, contented and, broadly speaking, prosperous. The majority of these people are simple and illiterate, and no particular genius would be necessary to induce them to part with their holdings for hard cash. They are not accustomed to the possession of more than a few dollars, and in nine cases out of ten money got for a plantation which keeps a family in permanent comfort would soon be squandered and the people would be beggars. The concession hunter is not a philanthropist usually; in fact, he is rather the reverse, and it would be sheer brutality to leave the whole body of small holders at his mercy. In countries far more advanced than Malaya it is found expedient to save the lower classes from themselves. In many parts of India deplorable results have followed the policy of *laissez faire*. Tens of thonsands of ryots have become the bond slaves of unscrupulous moneylenders, because the Government gave these Shylocks the benefit of legal support and made little or no attempt to save the peasant from their clutches. Few lower class Asiatics—few indeed of the lower classes in any part of the world—can resist temptations to secure a present advantage at the price of future embarrassment. They are like children, and the only Government that is of real service to them is one which does not shrink from being paternal, and which brushes aside nonsensical and inapplicable arguments about the liberty of the individual. We do not allow our children to destroy themselves by foolish indulgences. We coerce them for their own good.

If any considerable attempt is made to buy out the small plantation-holders, and if the law is insufficient to enable the Government to act paternally, we hope that a new law will be passed. Such a measure would not be in restraint of trade. A coconut tree grows quite as well, possibly even better in the vicinity of a native hut than it would do in a company-owned plantation. It does not need the same degree of skilled attention as the rubber tree. Coconuts are a perfectly sound form of investment, and there is ample land available which can be leased on very moderate terms, by anyone who applies for it. But that does not suit the company promoter. He wants to buy a few acres of trees in bearing, to take up a thousand or two acres of jungle at a cost of about $5 per acre and to palm off the lot upon the British public at five or six times what he has spent upon it. If he can get a few needy public service pensioners, or one or two grey-headed money grubbers with titles to join him in his conspiracy the promoter feels that he is doing well. But we have quite enough watered capital in Malaya as it is, and desire no more. True, there are plenty of men who will damn the Government up hill and down dale for its interference. They are the people who would get jackal-pickings when the lions of finance were gorging themselves on swindling promotions. The Government can hear their damns with equanimity. It is not on bursts of activity for a few months that the financial stability of a state can be founded, but upon the honest investment of capital in solid business which has a fair chance of returning good profits Any company which gets a real expert to select suitable land, which buys that land direct from the Government for its shareholders, and which plants coconuts under an efficient and honest manager will in due time have a most valuable property, and be able to pay a high rate of interest. There are difficulties, no doubt, the greatest being the fact that coconut trees take about ten years to mature, and seldom yield more than thirty to 40 nuts each per season until they are at least seven years old. On the other hand, knowledge of coconut cultivation is much more complete than knowledge of rubber trees, the yield is more regular, the organisation of labour more easy, and the expenditure on cultivation less. To people who are in a position to wait for a return on their money, it is as sound an investment as can be named. But there is not going to be a copra boom like unto the boom in rubber, and there is no room for reckless speculation or for swindling. A coconut proposition has got to start and work right through on what we have described in another connection as "natural capital," and we shall do our utmost to thwart any attempts that may be made to embarrass the future of Malaya by persons whose moral code is summed up in "beggar my neighbour."
—*Straits Times*, September 9.

COLOSSAL BANANA FAILURE.

DANGERS OF OPTIMISM.

In 1907 the cocoa plantations of Surinam, in Dutch Guiana, were destroyed by a devastating disease. Naturally the Dutch colonists were anxious to make good their losses, and their thoughts turned towards the most lucrative of all fruits—the banana. Just about that time the banana trade boom began in England, and far-seeing folk were convinced it had come to stay. Nor were they wrong in their estimates. Ever since then growers and shippers of bananas have prospered to an extent that arouses the envy of many trading communities.

Stimulated by the example of the Canary Islanders who grew bananas when the cochineal industry was no longer remunerative, the inhabitants of Surinam thought they could not do better than follow suit. Landowners approached the Dutch Colonial Government for assistance, and were granted money wherewith to begin the cult of bananas. Large sums were advanced to put the enterprise on a sound basis, and a three-sided contract was entered into. The Colonial Government of Surinam provided money, the Dutch West India Mail Company ordered four

fine vessels of 3,200 tons each, and the United Fruit Company of Boston undertook to buy the fruit, and at the same time guaranteed a minimum freight.

Two of the ships were built in Belfast, and two in Amsterdam; and all were fitted with the special facilities for carrying bananas as introduced by Elders and Fyffes (Ltd.)

So far the arrangement seemed highly satisfactory to all parties concerned. They had the ships, they had the men, and they had the money too.

Unfortunately the bananas were not forthcoming. Although Surinam is apparently in the banana-growing part of the world, it was found impossible to grow the fruit successfully. Ever since its inauguration the venture has proved a lamentable failure, and the three contracting parties have lost heavily on the deal.

About four years ago the steamers were ready, and during the whole of that period not more than a third of a cargo per vessel has been forthcoming. The boats had each a carrying capacity of 40,000 bunches. Now the whole affair has been abandoned, and the ships will no longer call at Paramaribo, the port of embarkation. The United Fruit Company have bought the vessels—which originally cost over a quarter of a million sterling—and will use them on their other routes. It is quite impossible to estimate the total loss incurred.

Other Disasters.

The phenomenal success of the banana trade has attracted many people. It is only to be expected that fortune hunters would rush in. Vast wealth has been attained in Costa Rica, Santa Marta, and Jamaica by means of the popular fruit; yet it seems very difficult to hit upon the right spot to grow bananas. At the present time the world is being searched for suitable ground for the cult of the "wise man's fruit." Even the wise men who have done well with bananas have made many mistakes. Thus the attempt to grow bananas in fertile Cuba was utterly futile. Another abortive effort took place in Panama. In both these instances the United Fruit Company sustained severe reverses.

No difficulty whatever is experienced in selling bananas, the trouble is to get them; and that is why the very word "banana" on a prospectus acts like magic. So many are apt to assume that the fruit will grow in any tropical country, but even the greatest experts have been deceived on that point. Growing bananas is playing for a big stake. Should the fruit flourish then the reward is indeed golden, but failing that the debit balances are such as to terrify merchant princes. There is an indissoluble association between bananas and shipowning, and failure with the fruit means losing valuable ships. Those who have the temerity to enter into the field must be prepared to think in millions. The disaster at Surinam is but another illustration of the the perils of fruit-growing. There are no half measures in regard to bananas—it is fortune or extinction.—*Daily Telegraph*, Sept, 10.

RUBBER IN BURMA.

Though the history of rubber cultivation in Burma dates back to so long ago as the late seventies, it was only about a decade ago that the plantation industry came to be placed on a commercial basis, and the most noteworthy feature in the history of modern agriculture in the Province is the rapid strides made in the cultivation of this valuable product. Rubber planting in Burma has long since passed the experimental stage and though the industry is still comparatively young when we consider the extent of the areas under rubber in the Federated Malay States and the Straits, it is nevertheless a fact that rubber cultivation is one of the successful commercial enterprises in this Province. As in all industrial ventures demanding the expenditure of large sums, private enterprise for some years was slow in embarking on the industry on a commercial scale; but as experimental cultivations carried on over a series of years in various centres showed that Burma was an ideal place for the cultivation of rubber, the hesitancy and diffidence which early marked the history of the industry disappeared and Burma at the present day has a right to be considered as one of the important centres of plantation rubber cultivation. In view of the present activity it may be interesting to observe that the plantation product now covers an area of nearly 33,000 acres showing an increase of 265 per cent. as compared with the area of five years ago. Rubber is is now cultivated in ten districts in Lower Burma and in the Bhamo, Myitkyina Katha and Yamethin districts of Upper Burma. The areas in the more important rubber-growing districts during the five years ending 1911-12 are respectively as follows:—Hanthawaday, 2,627 acres, 3,189 acres, 3,724 acres, 3,814 acres and 5,903 acres; Toungoo, 1,857 acres, 2,368 acres, 2,213 acres, 2,587 acres and 2,477 acres; Thaton, 11 acres, 97 acres, 97 acres, 3,488 acres and 4,133 acres; Amherst 100 acres, 100 acres, 168 acres, 676 acres and 1,450 acres; Tavoy, 109 acres, 406 acres, 666 acres, 1,013 acres and 2,381 acres; Mergui, 4,239 acres, 5,540 acres, 5,762 acres, 5,932 acres and 13,103 acres; and Myitkyina, nil, 50 acres, 800 acres, 2,382 acres and 2,712 acres The total Provincial area during the same period has been 8,987 acres in 1907-08, 11,849 acres in 1908 09, 13,525 acres in 1909-10, 20,100 acres in 1910-11 and 32,772 acres in 1911-12.

The most remarkable increases have been in the Tenasserim division and in the Myitkyina district. In Thaton where two years ago there were only about 100 acres under rubber, the area now amounts to over 4,000 acres; the cultivation, so far, promises well and a further expansion is anticipated in the near future. Large tracts in Shwegyin are now cultivated with rubber and new tracts are being applied for both in Shwegyin and Toungoo townships, while in Tavoy rubber planting is proceeding apace and applications for grants or leases of land continue to be received. A grant of 2,000 acres is being worked by one planter but Mr. Marshall has disposed of his plantation above Ye Byu. In Mergui also rubber cultiva-

tion has caught the popular fancy principally as the direct result of the successful exploitation of the product through Government agency and the area now amounts to no less than 13,103 acres, rubber in the district now occupying tho position of one of the staple crops. The area under rubber in Amherst, which now measures 1,450 acres, has more than doubled itself during the past year. The increase is due to the areas planted in tho leases issued to tho Amherst Rubber Estate, Ltd., and to the Maulmain Rubber Plantations, Ltd. These two estates have become well established and other small estates are also springing up rapidly. It is confidently expected tbat in a few years rubber plantations will form one of the important agricultural industries of the district. It might be remarked tbat the figure 1,450 acres abovo represents the area actually under rubber and that it is only about 20 per cent. of total area, 7,625 acres, already granted or leased. The increase in Hantbawaddy is due to the extension of their estates by the Rangoon Para Rubber Company, Ltd., to the issue of new leases and to 150 acres of the Twante grant having been brought under cultivation recently. The cultivation of rubber in Katba, Myitkyina, Yamethin, Henzada and Salween is a recent introduction. Nevertheless the area in Myitkyina where the cultivation really began four years ago now amounts to 2,712 acres, Mr. Kearney Young's estate being reported to account for over four per cent. of the total area in this district.—*Rangoon Gazette*, Sept. 2.

THE FERTILISING OF RUBBER.

Though rubber planting has been established on a paying basis in many tropical lands, there can be no doubt that but little is known about the correct manurial treatment of the trees.

In temperate climates, where the science of agriculture has been built up, the conditions are so entirely different from those obtaining in the tropics that it is difficult to apply the knowledge gained in the one to the problems in the other. One can at present only apply the general principles, adapting them as far as possible to tropical conditions.

The difficulties are great with regard to the treatment of most tropical vegetation, but especially so in the case of rubber, where trees of all ages have to be dealt with, even up to three-quarters of a century old.

Experimental information with regard to the use of fertilisers on rubber plantations is practically non-existent, but there appears no reason why the success obtained from a judicious use of fertilisers on forestry and nursery stock should not be repeated in the case of rubber trees.

The results of experiments with forestry have proved that the supplying of the necessary plant foods, in the shape of fertilisers, has a marked effect on the health and vigour of the tree—especially in its earlier years—and there is no reason to doubt that equally good results may be obtained with rubber trees.

Again the manuring of fruit trees in orchards has been followed by very gratifying results. In their case the manures are applied in a trench dug around the tree to a depth of about 18in. The trench should be at such a distance from the stem as to be directly over the young rootlets—in the case of fruit trees just outside the spread of the branches.

Questions of soil and climate having been carefully studied, and the planting completed, there remain the important details of cultivation and fertilising. It may be said without hesitation that young rubber trees respond as promptly to cultivation and artificial care as other tree crops, and thus, to ensure success, cultivation is not only desirable, but necessary.

The main object is to bring the young trees to maturity as quickly as is consistent with healthy growth, for financial success in rubber-growing must be largely influenced by the methods adopted to hasten the maturity of the trees.

No hard and fast rule as to the quantities to apply can be laid down, and direction must be exercised according to the age of tree, requirements of the soil, etc., but the first step to be taken, adopting ordinary scientific methods, is to have an analysis made of the soil and then to supply such elements of plant food as may be found wanting in the shape of phosphates, potash, and nitrogen. At the same time the necessary humus should be supplied to the soil by growing suitable green crops between the rows, and ploughing in.

As has been said, it would be impossible, in a short article, to go into details as to what particular materials and what quantities of fertiliser should be used, but the planter cannot afford to neglect the general question of rational fertilisation, and it is only by constantly experimenting *under his own conditions* that he will eventually learn the methods best suited to those conditions.

As time goes on, there will no doubt be many experiments made and results published by scientific authorities, and general principles will be deducible therefrom, but there is nothing like repeated experiments on one's own plantation, especially when, as often as not, there are experts ready and willing to assist.

On one point, however, there is some reliable information resulting from the experiments, made by Dr. Wilcox in Hawaii, on the value of nitrate of soda in increasing the flow of the latex. Further experiments have been in progress for some time and the results will be published in due course. In the meantime, the following has been published by Dr. Wilcox as the result of his preliminary investigations:—

NITRATE OF SODA FOR INCREASING FLOW OF LATEX.

"It has often been suggested that a scheme of fertilisation might be devised whereby the flow of latex could be temporarily energised at each tapping period. In order to gain evidence on this point, a series of experiments were undertaken in Hawaii with nitrate of soda. The fertiliser was applied, at the rate of one-fourth and one-half pound per tree, a few days before tapping. It was found best to incorporate the fertiliser deeply and thoroughly in the soil over

the young and actively growing rootlets. If the soil, at the time of application, be excessively dry, immediate effects may not be noticed from the application of nitrate of soda until a rainfall occurs, or until artificial irrigation is applied. If, on the contrary, the soil is moist at the time of application, and gentle rains occur soon afterwards, quite striking results are shown within two or three days, but a deep and thorough incorporation of the nitrate in the soil will be of advantage. In some cases the yield of Ceara rubber trees was doubled during the fall tapping period by the application of one half-pound of nitrate of soda per tree. It has not been determined exactly how the nitrate of soda brings about this stimulation in the flow of latex, but the fact appears to be true, and is believed to be well worth considering at tapping time on commercial plantations. The coagulation of the latex likewise appears to be much improved from the use of the nitrate of soda."

A simple experiment on these lines, following the advice as to moisture, and thorough incorporation of the nitrate in soil, can be easily carried out on any plantation at very small cost and, as Dr. Wilcox remarks, such a trial is well worth considering at tapping time on commercial plantations.

M. H. P.

—*Rubber World*, Sept. 19.

OPENING RUBBER ESTATES.

How the Steam Plough Has Worked On Devon Estate, Malacca.

We have received the following copy of a report dealing with the method in which Devon estate, Malacca, has been opened up :—

The results of the scientific methods employed in opening up this estate have been highly satisfactory, and show what can be done by boldly leaving the beaten track. The estate at present consists of two divisions, North Devon with 300 acres planted and 1,950 lalang; South Devon, 2,150 acres (of this it is estimated 200 are taken up by swamps, house and village reservations, etc.), giving a total area of 4,500 which it is proposed to plant up by end of June, 1913.

The oldest trees are about 19 months and have a growth equal to any upland trees of that age I have seen, whilst the newly planted clearings all seem to be growing well. Planting distance is 22′ × 22 diagonally, which gives 104 trees to the acre.

The land has been well chosen for this form of culture, being practically flat, and there should be little or no trouble from wash at South Devon. The northern division, however, has several hills which will probably cause some trouble at a later date.

The unopened country at North Devon is going forward in a manner decidedly novel to one accustomed to the ordinary method of felling, burning and stumping, etc. Any bluker growing amongst the lalang of which almost, the whole area is composed, is first grubbed out by the roots, and burnt clean. The cattle drawn mowing machines then cut down close to the ground all lalang, which is burnt off. The next step is the plough, a great double ended affair drawn backwards and forwards between two cable engines standing a quarter of a mile apart. These engines are capable of ploughing 10 acres in a day, and very soon open up the soil for the disc harrows which are worked on a similar principle by a second pair of engines following behind. When the soil has been broken up and rendered friable the dead lalang on the surface is collected with a flat harrow drawn by the same power. The land is now ready for holing and planting. Any lalang left alive dealt with in the ordinary course of weeding, which is being done at a very low cost per acre.

Various manurial experiments are being made, amongst which is the sowing of ground nuts (legume) It is hoped that the seeds of these will cover cost of cultivation, whilst the leaves and stems will be ploughed in as manure. It will be interesting to hear the result of this experiment, as the ground nut reduces the cost of weeding to practically nil, and will also stop any tendency to wash after heavy rain.

The estate is situated at the 18th and 21st miles on the Merlimau Road and is said to be exceptionally healthy, none of the staff up to now having been sick at all.

Labour is all free and consists of Malays drawn from the neighbourhood, whilst there are a bare number of Chinese working on contracts.

Without wishing to be too enthusiastic, this is one of the finest estates I have yet seen, and at the low capitalisation of £20 per acre —at which it is hoped to bring the total area desired into bearing—should become one of the best paying rubber companies in the East.—*Straits Times*, Sept. 7.

PLANTING RUBBER IN SEYCHELLES.

The Colonial Office report on the Seychelles for 1911 states that the quantity of tortoise shell exported was over a ton, valued at R41,597, the prices ruling high throughout tho year. The markets are London and Paris. The number of turtle captured each year varies, but the average quantity of shell obtained shows no diminution. Some interesting experiments are being made in the rearing of young turtles from the egg in enclosed areas. The Government has advanced on easy terms the capital required by the lessee of one of the Crown Islands, and there seems at present a likelihood that the venture may prove successful. The "carets" grow more rapidly in confinement than in the open sea, and the weight of shell is proportionately greater, but many difficulties have yet to be surmounted before the experiments can be pronounced to be successful. The planting of Para rubber, the report continues, advances steadily; 62,000 seedlings have been planted out in 1911 from the seeds of rubber trees growing in Seychelles. Rubber appears as an export for the first time in 1911, viz., kilos. 132, which realised the full prices of good plantation rubber. Some 25,000 trees will have reached a tappable size in 1912. —London *Times*, Aug. 26.

HANDLING TEA IN LONDON.

Under the heading, 'Handling Tea in London,' the *Tea and Coffee Trade Journal*, New York, describes the methods followed in the metropolis by those who handle tea from its arrival. The article is accompanied by illustrations, including one of the tea auctions, and it concludes with a reference to old and modern tea blending. The writer, Mr A Ibbetson, says: 'During recent years great changes have taken place in the London wholesale tea trade. In the old days the grocer made it his business to understand the teas he dealt in and, consequently, when he desired to replenish his stocks he always bought Indians, Ceylons, etc., in original packages, tasting the samples submitted to him carefully in the water of his district, and after selecting those which suited his purpose he would blend them himself—producing as far as possible a tea which had character and individuality. Times have changed, however, and although some distributors buy original teas and do their own blending, yet many buy what they require already blended. The majority of the large London dealers have moved with the times and have at their command the latest and most efficient cutting, blending, weighing, and packing machinery. Owing to the large stocks held by the London houses and the up-to-date character of the machinery used, it is possible to turn out a blend at a very low cost. In fact, by the aid of electricity the tea in the original packages is not touched by hand from the time it is received to when it is either repacked in chests or half-chests or weighed into packets as small as one ounce. The grocer, therefore, has a fine opportunity of retaining his tea trade if he will only study in a reasonable way the requirements of his customers. The quantity now consumed in England is over six pounds per capita. At the present time the family grocer is not selling his share of tea and he, unfortunately, hardly realises what an important asset it may become to his business if vigorously pushed. . . . . The tea trade is magnificent and wonderful, and there is ample scope for all those engaged in it, but brains and palate will count for little if only the cheapest teas are wanted. It is up to all, therefore, to do everything possible to elevate the trade, and by intelligent effort to educate the public, so that instead of the cheapest the best will be demanded.'

VEGETABLE BUTTER.

Butter, as the term (from a Greek word meaning "oxcheese") implies, was originally a name for a product obtained from the milk of the cow, and afterwards, by extension, for a like substance obtained from the milk of other animals, such as the ewe and goat. By a further extension, the name has been applied to certain fixed vegetable oils, the melting point, consistency and aspect of which resemble butter of animal origin, such as "butter of cocoa," a concrete oil of a sweet and agreeable taste obtained from the kernels of the fruit of Theobroma cacao or "chocolate-nut tree;" butter of "Bambuk," an oil obtained from a species of almond in Senegal, and used medicinally; and "butter of nutmegs" or "butter of maces," a sebaceous substance expressed in the East Indies from the arillus of the fruit of Myristica moschata. To the plants yielding such oils has been applied the name of "butter-trees," and to the oils themselves the term "vegetable butter." "The butter-tree" of Nepal is the Bassia butyracea, the seeds of which yield by pressure a semigold oil, which thickens and becomes of the consistency of lard. It is called "phoolma," "cherce," or vegetable butter," and is used for culinary purposes, and by the natives of rank, for anointing the body. The seed of Bassia latifolia, the "mahava-tree" of Bengal, yields a greenish, white oil which is of the consistency of butter, and which is used as such by the poorer classes. From the flowers of the tree is distilled a spirit resembling whisky which the natives like better and consume in large quantities. Another species of the same genius, B. longifolia, the illupie-tree, affords an oil similar to that obtained from the two preceding trees, and which is used by the Ceylonese for culinary purposes. The "butter-tree" of Africa, the seeds of which produce the "galam butter" or "shea-butter," mentioned by Mungo Park in his travels, is a species of the same genius B. Parkii. The fruit when ripe is the size of a peach, and, after being dried in the sun, is pounded in a mortar until reduced to flour. It is then mixed with water and boiled for a short time, when greasy particles become detached and rise to the surface, whence they are then skimmed. When cold the oil is of the consistency of butter and will keep fresh for two years.-"Scientific American."

THE SAPUCAIA NUT.

The tree (*Lecythis Zabucajo*) producing thy sapucaia nut is a native of Guiana, Brazil and Venezuela, where it grows to a great size, and bears its seeds in a large, very hard fruit provided with a lid at the top, which, falling away when it is mature, lets the seeds escape. These are what are commonly known as the nuts; they may be obtained often in the fruit shops in England, where they are sometimes sold in preference to the Brazil nuts, which are borne by a plant *Bertholletia excelsa*) belonging to the same Natural Order: as a matter of fact they possses a better flavour—sweet and somewhat resembling that of the almond—and are more easily digested than the Brazi nut. They yield an oil which, like that of the last mentioned nut, is employed in South America as a food oil and for soapmaking; it shares with this oil the disadvantage that it becomes rancid in a very short time.

By the courtesy of the Trinidal Department of Agriculture, plants of *Lecythis Zabucajo* have been supplied to the Dominica Botanic Garden, and that Department is co-operating further with the Commissioner of Agriculture by sending plants of the same kind to other Botanic Stations in the Lesser Antilles. —*Agricultural News.*

GUANO FROM SEYCHELLES.

Suitable for Ceylon Soils.

The output of guano from the Seychllees was 21,910 tons in 1911, compared with 23,039 tons in 1910 The output for 1912 and 1913 will probably (says the Governor in his annual report) be larger, but after that there will be a gradual diminution, and at the present rate ot exploitation the supplies will probably last for another ten years.

The above from the leading paper on fertilisers should be of interest to your planter readers who would find this guano far more suitable to Ceylon soils, than Basic Slag which is a hard fused material, however finely it may be ground.—*Cor.*

ERADICATION OF FOMES SEMITOSTOS FROM HEVEA PLANTATIONS.

Dear Sir,—With reference to an article on root diseases which appears in T. Petch's book "The Physiology and Diseases of Hevea Brasiliensis" and the sentence in same statng that "it is impossible to get rid of fomes semitostus if the stumps which bear the fungus are not removed ; neglect of that operation is the chief source ot danger ;" it is generally recognised, I think, that such a method is far too costly to be undertaken with any degree of completeness. Even the destruction ot all loose timber, which has escaped burning, involves a huge outlay, and Managers as a rule, are rather shy of taking such effective, yet ccstly steps.

What must, and can be done is, a system must be devised on affected plantations, whereby the *thorough prevention* of the disease is aimed at. People who offer rewards for the *cure* of the disease, are fairly safe with their money but of little use to the planting community, considering how difficult it is to discover the disease early enough to prevent serious damage or death to the trees attacked. It would be rather more beneficial to reward the person who gave the *simplest*, *cheapest* and *surest* idea for the *thorough prevention* of the disease rendering the affected plantation and district safe from attack.

Let it be a matter of competition between all planters in the East, and let all ideas be sent in to a committee of experienced men, who will decide which is the best idea. Then let a thorough trial be made and full particulars be kept as a record. After a trial of say 12 months, or some period determined on, let the full results be published. Should the idea be a complete success, then and only then, let the inventor of the system be rewarded.

Trusting that you will find this letter interesting enough to afford space for it.—I am, Dear Sir, Yours truly,

"Bode."

British North Borneo, 8th August 1912.

—*Grenier's Rubber News*, Aug. 31.

CONSULAR REPORTS ON RUBBER.

Sumatra : Over £8,000,000 Invested—Thirty Companies Producing.

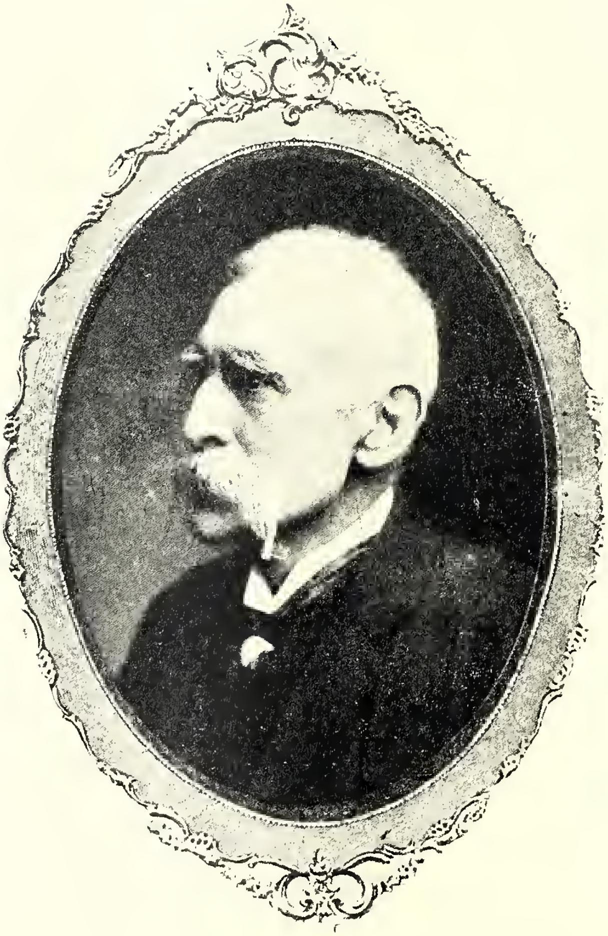
A British Consular report on the trade of Sumatra by Mr W J Stewart states : The cultivation of plantation rubber is already one of the most important industries in Sumatra, and bids fair to be a factor of very considerable importance in future in furthering the development of the East Coast. It is calculated that approximately five-eights of the whole capital invested is British. One or two hitherto unexploited districts have been opened up, and there is little doubt that even more would have been done in this direction had better means of communication by road and rail been available. A large number of companies intend to plant little or nothing further in 1912, but several are preparing to plant considerable areas. Reliable statistics as to the amount of capital invested in the rubber industry in Sumatra and the area under plantation rubber are unobtainable. Returns show at the end of 1911 approximately 130,000 acres planted, of which over 125,000 acres are Hevea Brasiliensis. It has been estimated that at the end of 1911 there were 50 British rubber companies operating in Sumatra with an issued capital of approximately £5,000,000 and a nominal capital of about £6,200,000. The following approximate statement of capital invested in the cultivation of rubber in the East Coast has been compiled: —British, £5,000,000 ; Dutch, £3,000,000 ; German, £30,000 ; Belgian, £62,000 : Swedish, £70,000—total £8,162,000. The above figures as indicated are admittedly only approximate. Some 30 rubber companies are now producing, but the majority of them have only recently commenced tapping, and that on a very small scale Official figures are not yet available but it is estimated that the quantity of plantation rubber exported from the East Coast of Sumatra during 1911 amounted to approximately 677 tons, of which about 550 tons were shipped to London.

Java Exports for 1911 Nearly 1,000,000 Lb

A British Consular Report on the trade of Java by Mr J W Stewart, just issued, refers to the rubber industry as follows :—

A fair number of the Java estates have now reached the productive stage, but the majority of these only began to tap on an extended scale towards the end of 1911, and so far no information on the subject of production, cost &c., has been published. Some statistics of this nature have been obtained privately, but as these refer mainly to a few young estates situated in one part of the island, it would be unsafe to use them as a basis for anything is the nature of a prediction as to the future of the rubber industry in Java. That Java estates can produce rubber of a superior quality is unquestioned, and, so far as can be judged from the figures at present available, the outlook is by no means discouraging, returns from the more advanced plantations showing a steadily increasing production per tree, and low cost. A few estates complain of labour difficulties, but as the industry develops and the cultivation of rubber becomes more familiar to the natives, these troubles will no doubt gradually disappear. Tapping is readily learnt by the coolies, and managers generally express themselves as satisfied with the daily task performed Exports of rubber from Java during 1911 amounted to 982,600 lb, as compared with 156,700 lb during the preceding 12 months, but some considerable part of this represents wild rubber from outlying islands.

—*Financial Times*, July 30.



H. A. Wickham